



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
REGARDING DEMONSTRATION OF PURGE AND VENT VALVE OPERABILITY (B-24)

MAINE YANKEE ATOMIC POWER COMPANY

MAINE YANKEE ATOMIC POWER STATION

- DOCKET NO. 50-309 -

1.0 Requirement

Demonstration of operability of the containment purge and vent valves and the ability of these valves to close during a design basis accident is necessary to assure containment isolation. This demonstration of operability is required by BTP CSB 6-4 and SRP 3.10 for containment purge and vent valves which are not sealed closed during operational conditions 1, 2, 3, and 4.

2.0 Description of Purge and Vent Valves

The valves identified as the containment isolation valves in the purge and vent system are as follows:

<u>Valve No.</u>	<u>Size</u>	<u>Use</u>	<u>Location</u>
VP-A-1	42"	Purge Supply	Outside Containment
VP-A-2	42"	Purge Supply	Outside Containment
VP-A-3	42"	Purge Exhaust	Outside Containment
VP-A-4	42"	Purge Exhaust	Outside Containment
VP-A-5	8"	Pressure Relief	Outside Containment

The 42" valves are all butterfly valves, Model No. 75WR manufactured by Allis-Chalmers. These valves are equipped with NQPAL Model No. DSS Class I double acting air cylinder operators manufactured by Galland-Henning. The operator assembly also incorporates a manual operator (Limitorque-H).

Presently these valves are limited to 50° (90° = full open).

The 8" valve is a globe valve Model No. 38-20521, manufactured by Masoneilan International Inc., and is equipped with air to open, spring close operator Model No. 38-18L, also manufactured by Masoneilan.

3.0 Demonstration of Operability

Maine Yankee's purge system consists of one air supply leg and one exhaust leg. Each leg contains two in-series 42.0 inch butterfly valves, each equipped with a double-acting air operator and associated accumulator. All valves are located outside containment.

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Maine Yankee would like to operate the 42" valves from a 90° opening but would agree to an opening limitation in order to use these existing valves.

The purge system also contains an 8.0 inch globe valve equipped with an air open-spring close operator. This valve is in a bypass line around the 42.0 inch valve VP-A-3 in the exhaust leg. The function of the valve is to depressurize the containment prior to initiation of containment purge.

Maine Yankee Atomic Power Company has provided operability demonstration information for the purge and vent system 42" isolation valves for the Maine Yankee plant in the following submittals:

A. Maine Yankee Atomic Power Company letter FMY-81-68, dated May 1, 1981.

In addition, the following references were used in reviewing this submittal:

B. Allis Chalmers test report VER-0209 dated December 17, 1979.

C. Allis Chalmers letter, April 30, 1981, R.H. Zeiders (AC) to M. Haughey (NRC). Subject: Butterfly valves for containment isolation, Allis Chalmers Valve Division Tests.

D. Maine Yankee Atomic Power Company letter MN-82-158, dated August 10, 1982.

E. Maine Yankee data sheet "Data for Containment Purge and Vent Valve Assemblies" undated.

Information submitted in Reference A indicates the following concerning the four 42.0 inch purge valves:

- a) Both supply and exhaust valves have the flat side of the disc facing containment.
- b) The aspect ratio (t/D) equals 0.152.
- c) Figure 10 (Test #32) and Figure 9 (Test #29) of Reference B represent the installation configuration and shaft orientation of the supply and exhaust valves, respectively.
- d) The aspect ratio of the disc in both test #29 and #32 is 0.17 vs. 0.152 actual.
- e) Single valve operation is considered by the analysis.

Allis Chalmers assesses the valves using the ramp-rise approach, i.e., using delay time, stroke time and containment response curve to establish valve loads. A delay time of 0.5 seconds, stroke time of 2.5 seconds, and a response curve showing peak containment pressure of 54.3 psig @ 20.7 seconds from start are used as the bases for the assessment presented.

Using the 0.5 delay time and an assumed 2.5 second closure time (said to be conservative based on a 1.5 second measured time for one of the valves), Allis

Chalmers established the containment pressure value at the point in time that the valve disc is closed. Using the assumption of a linear stroke time, and using the containment response curve previously mentioned, the containment pressure at valve closure was determined to be about 20 psig. From this, Allis Chalmers concluded the following:

- a) From pressure drop data (Tests 32 and 29) of Reference B, the pressure drop across the valve closely follows or exceeds containment pressure when 3.0 seconds (0.5 + 2.5) is used. The cylinder operators (using accumulator as worst-case) should provide adequate closure margin.
- b) Supply valves (Test 32 data) should close from 90° open with containment pressures up to 30 psig, provided that installed piping contributes to  $\Delta P$  to the extent that valve  $\Delta P$  is equivalent to or greater than the  $\Delta P$  in the test program. For containment pressures from 30 psig up to 60 psig, the valve should be capable of closing from 80°, again providing installation piping contributes resistance to assure valve  $\Delta P$  is equivalent to or greater than  $\Delta P$  from test data.
- c) Exhaust valve should close from wide open with containment pressures up to 50 psig, provided that connecting piping contributes resistance, etc.

#### 4.0 EVALUATION

4.1 The Allis Chalmers conclusions are not accepted for all opening angles of the valve since they are based on unquantified assumptions of piping resistance contributions. These assumptions have a significant effect on valve operability for openings greater than 50°. As can be seen by a review of the Allis Chalmers test data for both tests #29 and #32, at test pressures from 17 to 60 psig  $\Delta P$  across the valve varies from approximately 10% to 50% for valve openings of from 90° to 60° respectively. This indicates that piping resistance has a major influence on the  $\Delta P$  experienced by the valve for these opening angles. For valve openings of 50° or less (down to 0°), the  $\Delta P$  across the valve varies from approximately 80% to 100% of test pressure respectively, indicating that the effect of piping system resistance at these angles of opening is negligible. Therefore, for openings of 50° or less, the analysis given is acceptable. In order to justify any larger opening, some measurement of the actual piping resistance contributions for the accident condition analyzed should be presented.

For openings of 50° or less, the stress analysis presented in Reference A is appropriate and indicates that the weakest link is the valve shaft with a total shear stress (combined pressure and torque and seismic) of 15,919 psi. This is based on a torque of 80,488 inch pounds which is extremely conservative.

4.2 For the 8" globe valve, although there is no operability demonstration information submitted, Reference D does cite a statement by the valve manufacturer (Masoneilan International Inc.), that the valve will shut against a 55 psi differential across the valve seat. For this valve the basis of this statement and an analysis for valve operability for the DBA-LOCA, which would include the effects of seismic loads, was not given. Thus, the staff has no bases to conclude that this 8" valve would close during a DBA-LOCA.

An analysis which precludes any structural problems due to valve closure during the accident for which the 42" valves were analyzed would suffice. Reference E gave a valve closure time of 10.9 seconds for this valve. This is considered acceptable under our Generic Containment Purge Radiological Consequences Analysis sent to Maine Yankee by letter dated January 19, 1983.

4.3 Reference C is a letter from the valve manufacturer which points out a particular valve orientation which produces high torque coefficients at very low disc angles (near the closed position). Figure 10, Appendix III of Allis Chalmers test report VER-0209 (Reference B) shows the valve opening to the right. If the valve opens to the left in this configuration, very high torques are produced at disc angles of less than 20 degrees.

Maine Yankee has stated that two of the valves under review, VP-A-1 and VP-A-2 are as represented by Figure 10 of Reference C.

The evaluation is based on similarity of operation between the valves as installed at Maine Yankee and the tests by Allis Chalmers documented in test report VER-0209 (Reference B).

#### 5. Summary

We have completed our review of information submitted to date concerning the operability of containment purge and vent valves for Maine Yankee. Section 4.2 is the basis for the conclusion drawn by the staff regarding the 8" Pressure Relief Valve. We find the information submitted failed to demonstrate the ability of the 8" valve to close against the buildup of containment pressure in the event of DBA-LOCA. For this reason the valve should be sealed closed in accordance with SRP Section 6.2.4, II.6.f. Furthermore, this valve should be verified to be closed at least once every 31 days.

The operability of valves VP-A-1, VP-A-2, VP-A-3 and VP-A-4 during a DBA-LOCA from the full open position (90° is full open) has not been demonstrated. However, operating these valves from the 50° opening angle position (or less than 50°) would be acceptable to the staff provided mechanical stops or the equivalent are in place to assure valve opening angles not more than 50° during operating modes 1, 2, 3 and 4. The licensee should confirm that the present interim position with regard to the 42" valves will be the long term position. Otherwise, the 42" valves should be sealed closed in accordance with SRP Section 6.2.4, II.6.f. Furthermore, these valves should be verified to be closed at least every 31 days.

Principal Contributor:  
R. Wright